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(54) **LID OPENING AND CLOSING DEVICE FOR VEHICLE**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,331,353 A * 5/1982 Yazawa F16C 1/101 292/28
9,037,313 B2 5/2015 Inoue et al.
(Continued)

FOREIGN PATENT DOCUMENTS

JP 2013-124487 A 6/2013
JP 2016-117313 A 6/2016
JP 2016-223150 A 12/2016

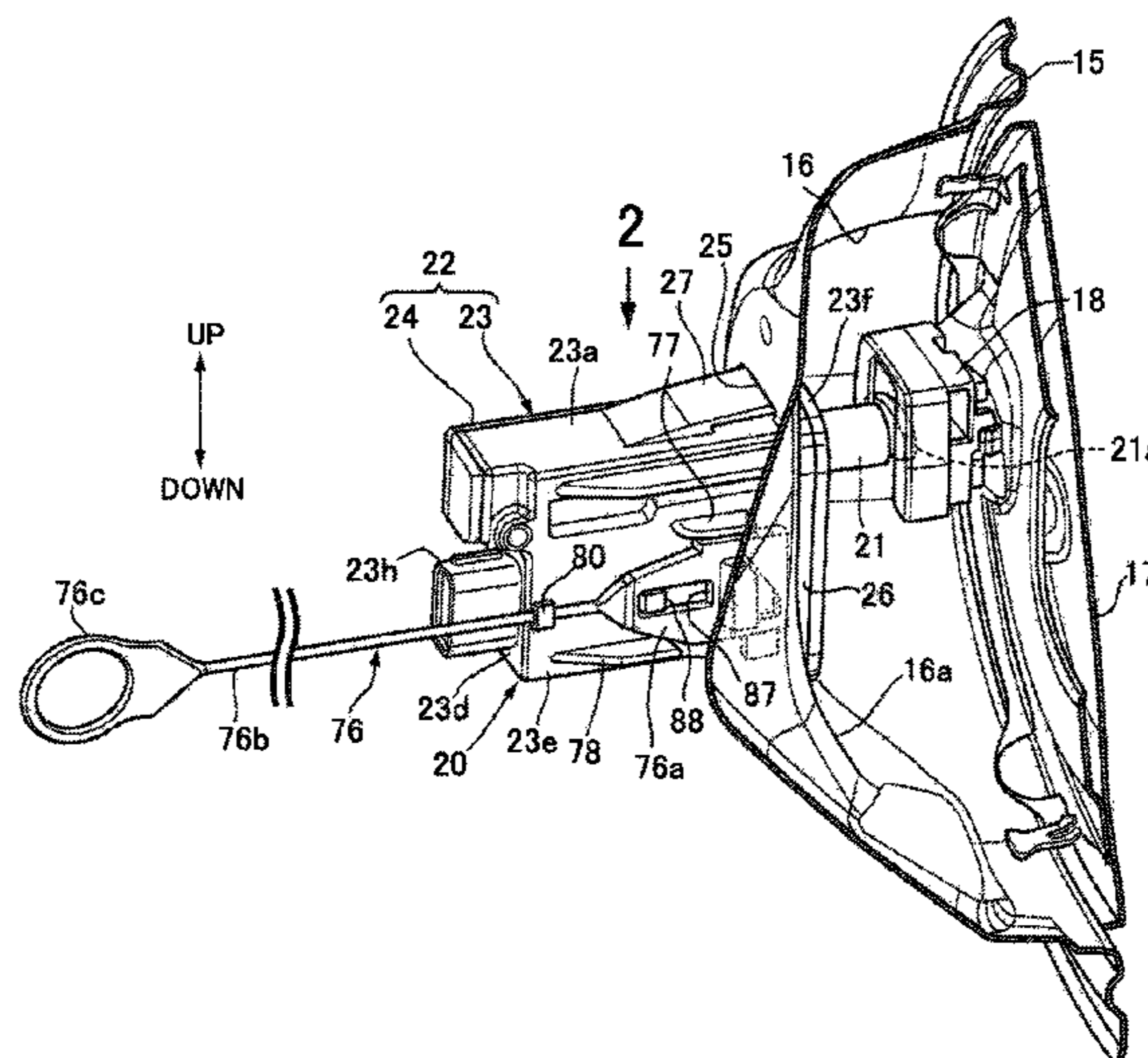
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(57) **ABSTRACT**

A lid opening and closing device for a vehicle which includes a restriction member that can operate between a restriction position at which movement of a rod at the lid closed position is restricted and a restriction release position at which the restriction is released, an electric motor that operates for a predetermined time in response to a door switching between a locked state and an unlocked state for driving the restriction member, and a case that houses the restriction member and the electric motor, wherein at least the restriction release position of the restriction member is resiliently held by a holding mechanism. Thus, even when the restriction member stops at position halfway between the restriction release position and the restriction position, convenience is enhanced by carrying out an operation of locking the door by moving the rod to the lid closed position without requiring an unlocking operation.

3 Claims, 13 Drawing Sheets



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(56) **References Cited**

U.S. PATENT DOCUMENTS

9,944,172	B2 *	4/2018	Basavarajappa	B60L 53/68
10,173,523	B2 *	1/2019	Persiani	E06B 3/36
10,526,822	B2 *	1/2020	Kitamura	E05B 65/00
10,683,685	B2 *	6/2020	Sonobe	E05B 81/36
10,919,382	B2 *	2/2021	Kato	E05B 83/34
2014/0291996	A1	10/2014	Basavarajappa et al.	
2015/0061314	A1 *	3/2015	Beck	E05B 81/66 296/97.22
2016/0375762	A1 *	12/2016	Lee	B60K 15/05 296/97.22
2017/0043660	A1 *	2/2017	Horikawa	E05F 1/105
2018/0195321	A1 *	7/2018	Zhang	E05C 19/022
2021/0270063	A1 *	9/2021	Maeda	E05B 77/34

* cited by examiner

FIG.2

INNER SIDE IN VEHICLE WIDTH DIRECTION → → OUTER SIDE IN VEHICLE WIDTH DIRECTION

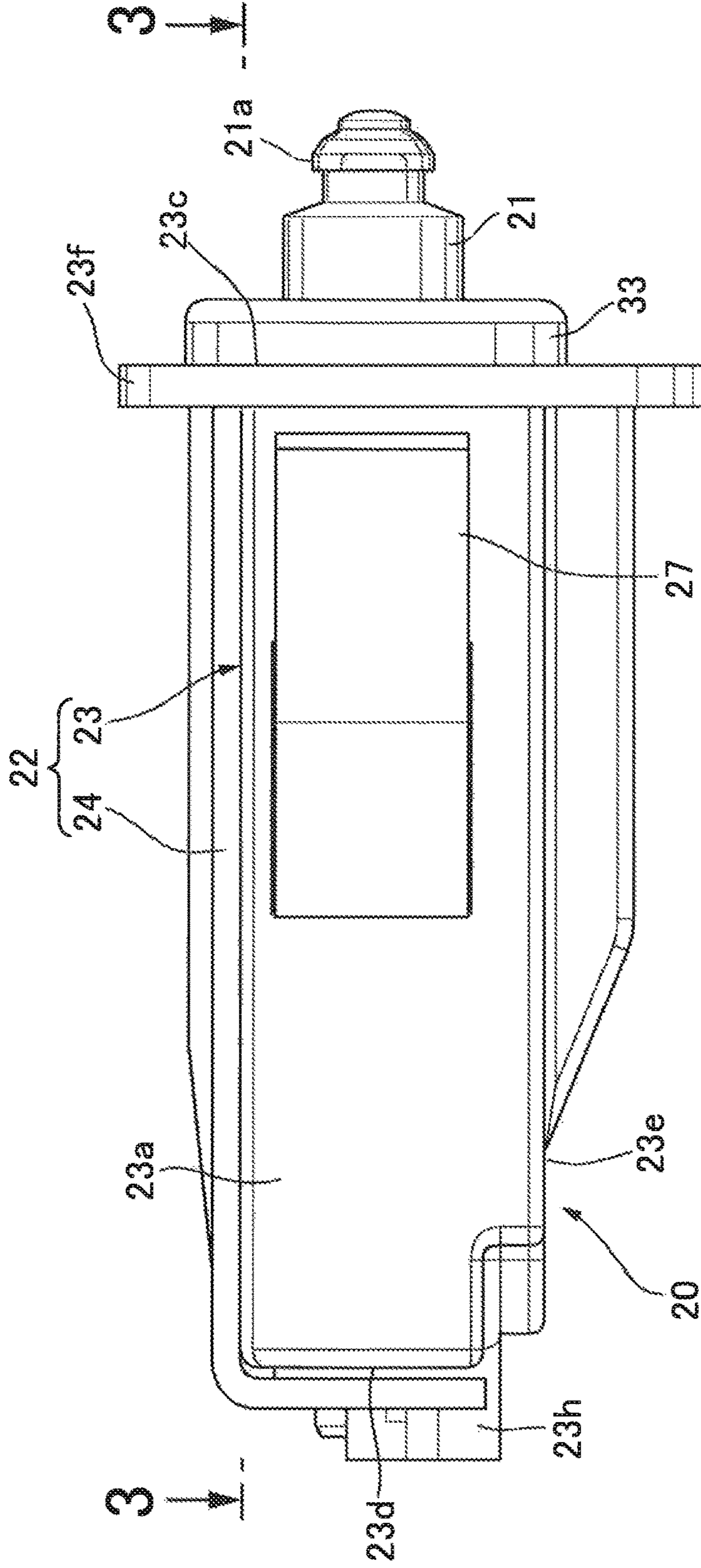


FIG.3

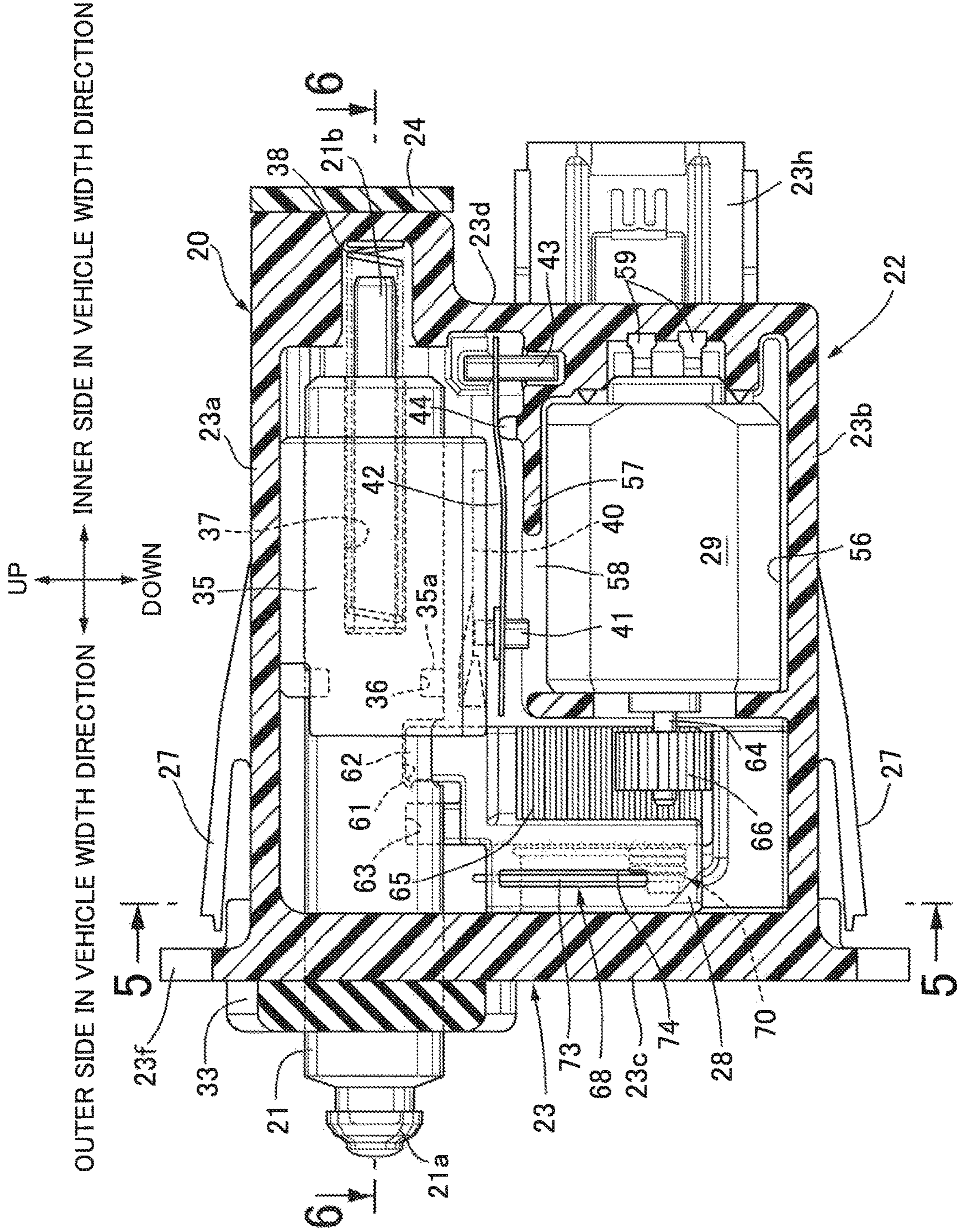


FIG. 4

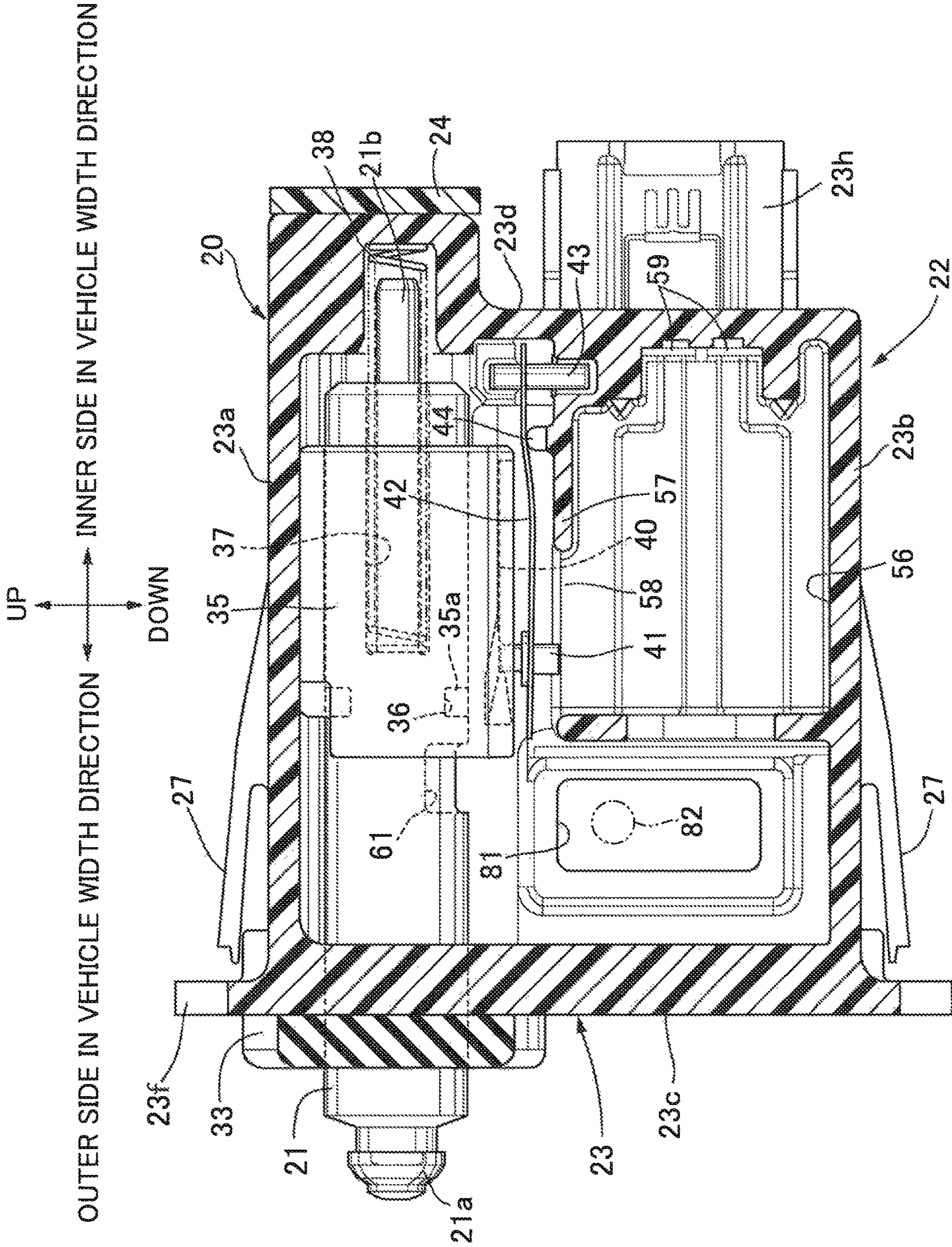


FIG. 5

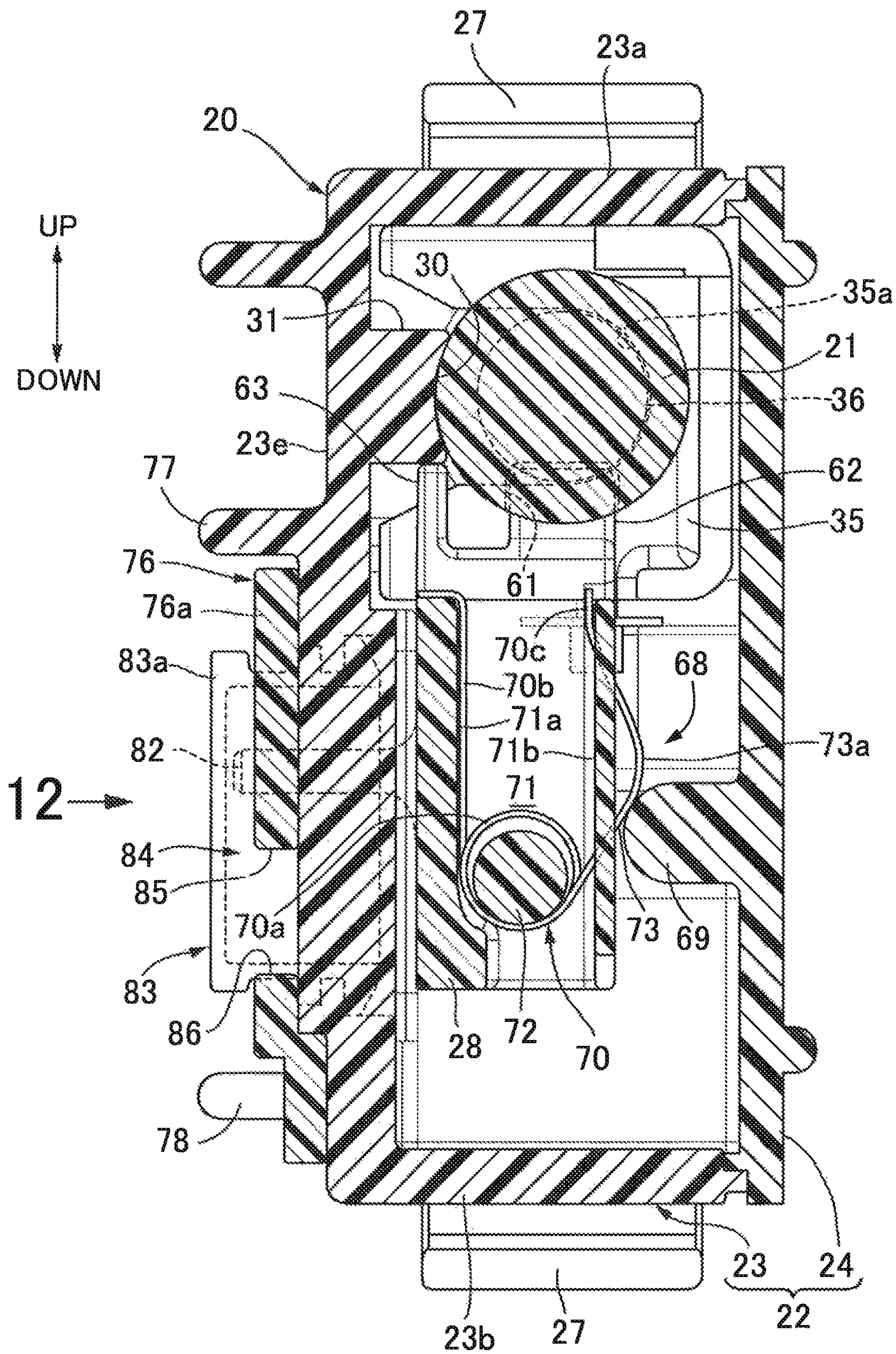


FIG. 6

OUTER SIDE IN VEHICLE WIDTH DIRECTION ← → INNER SIDE IN VEHICLE WIDTH DIRECTION

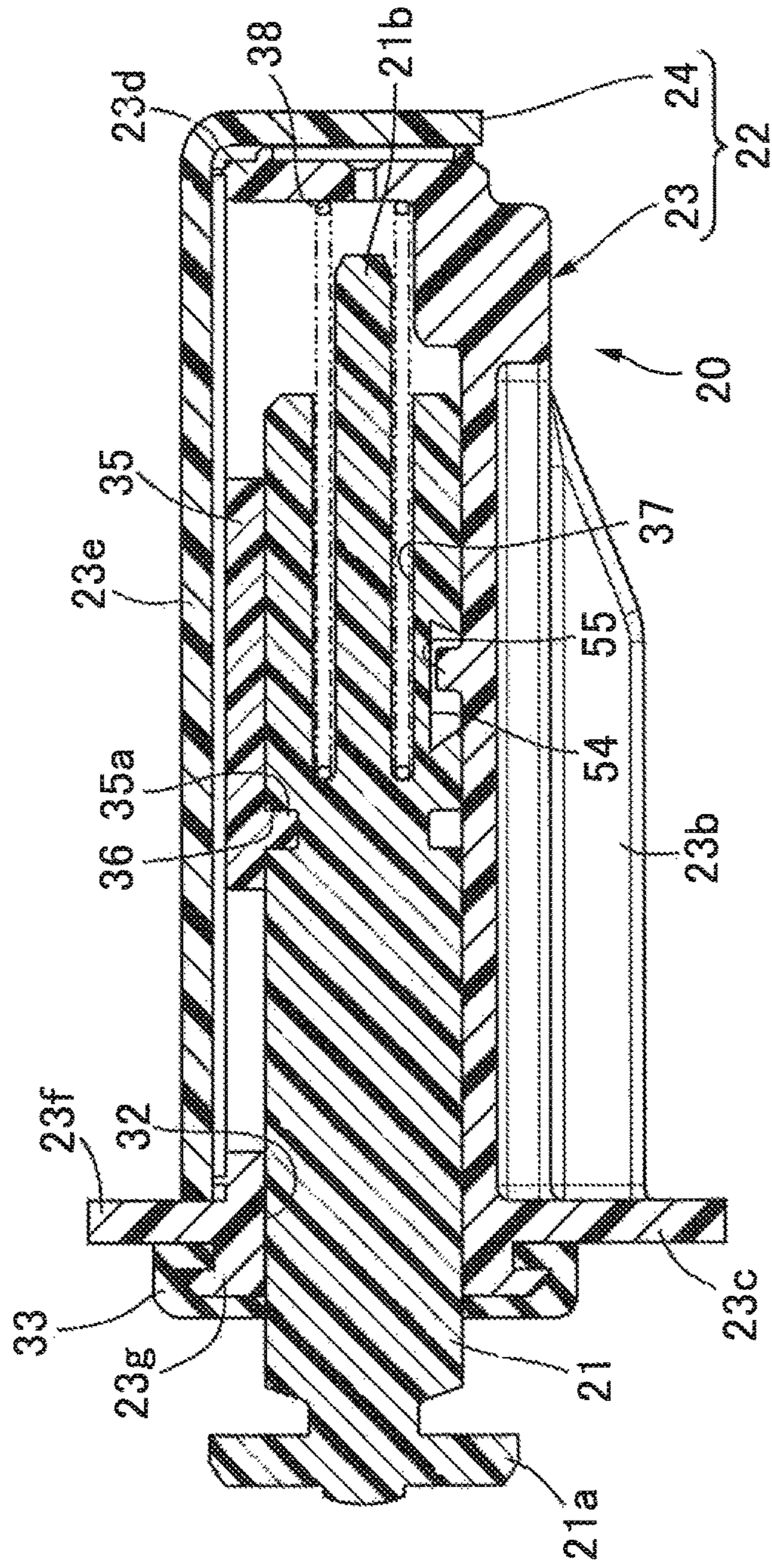
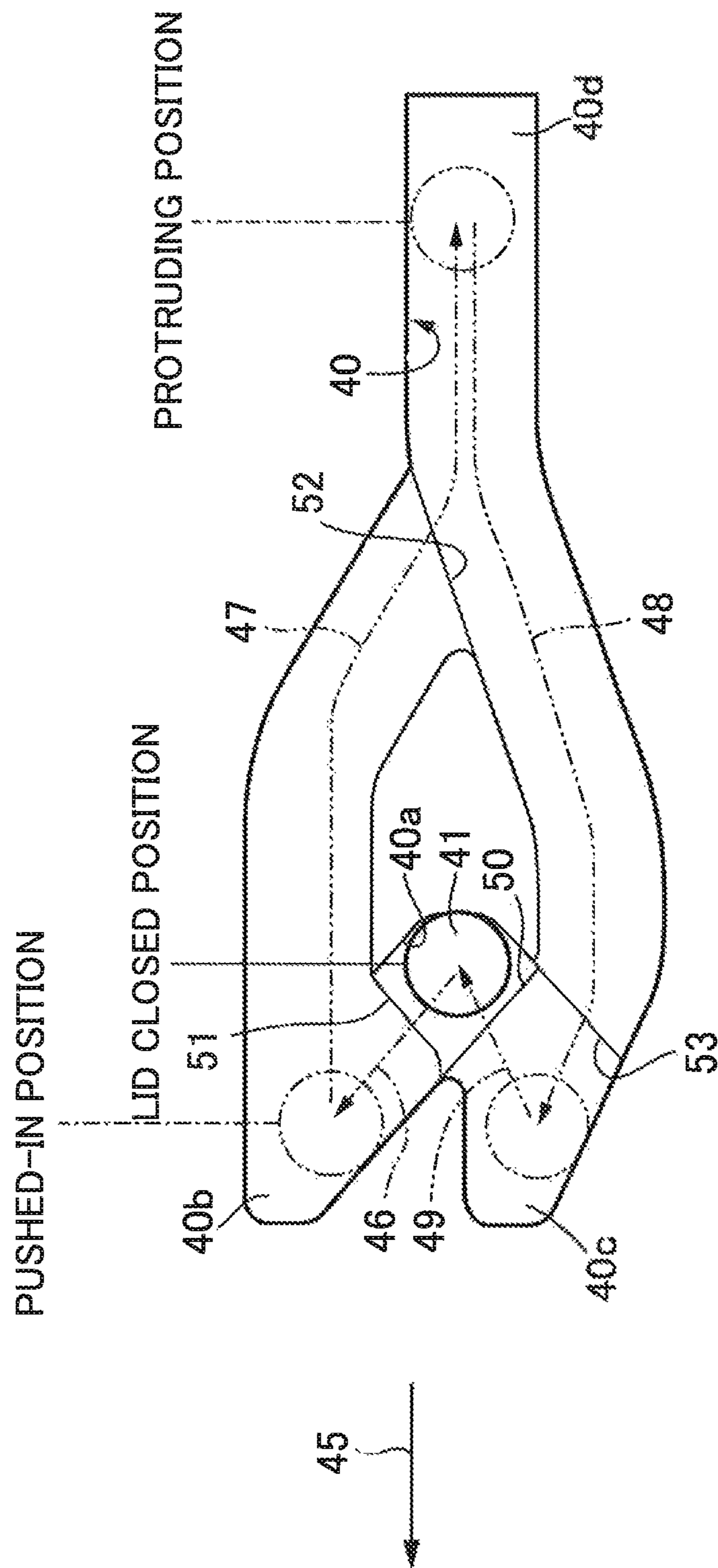
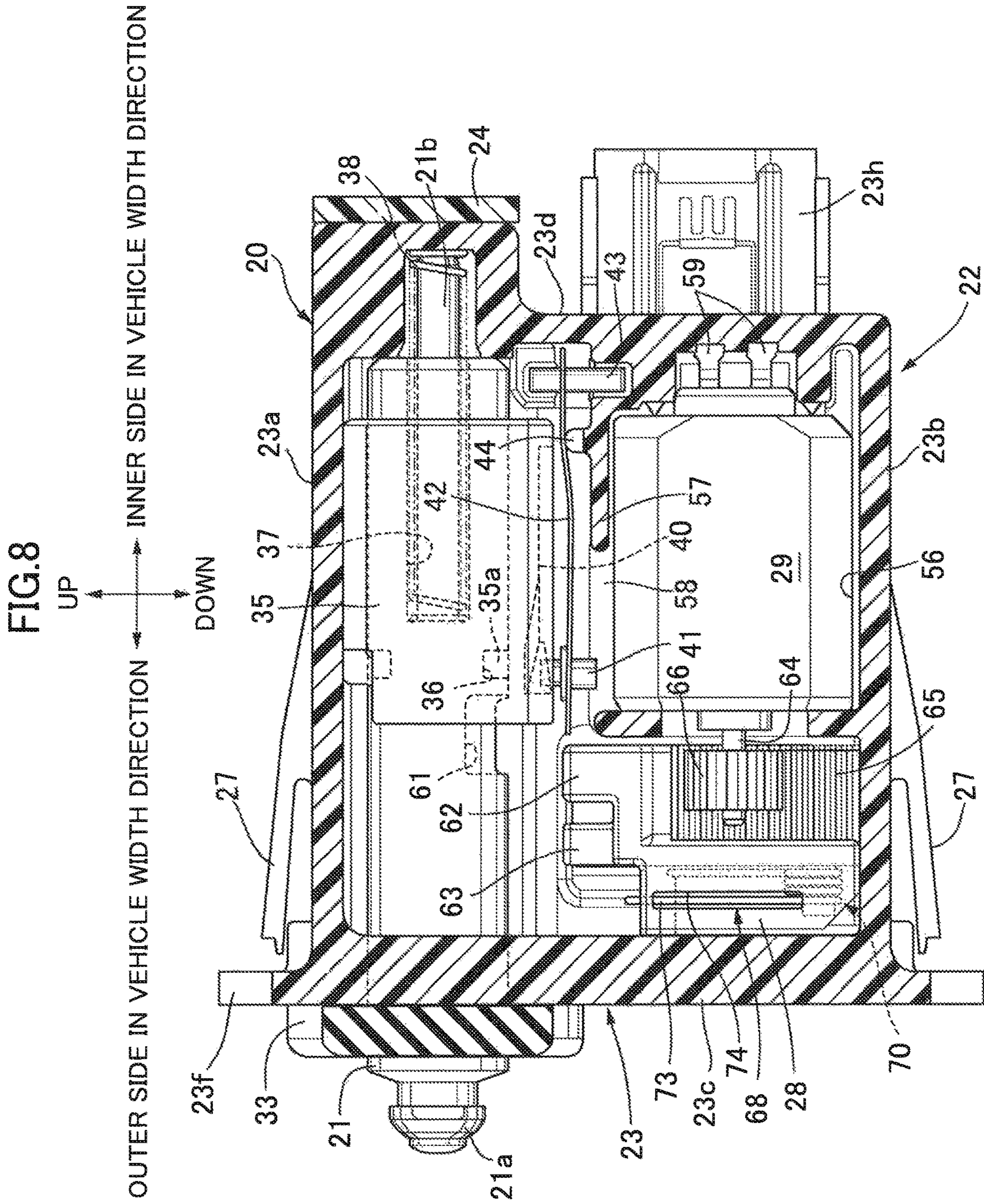


FIG. 7





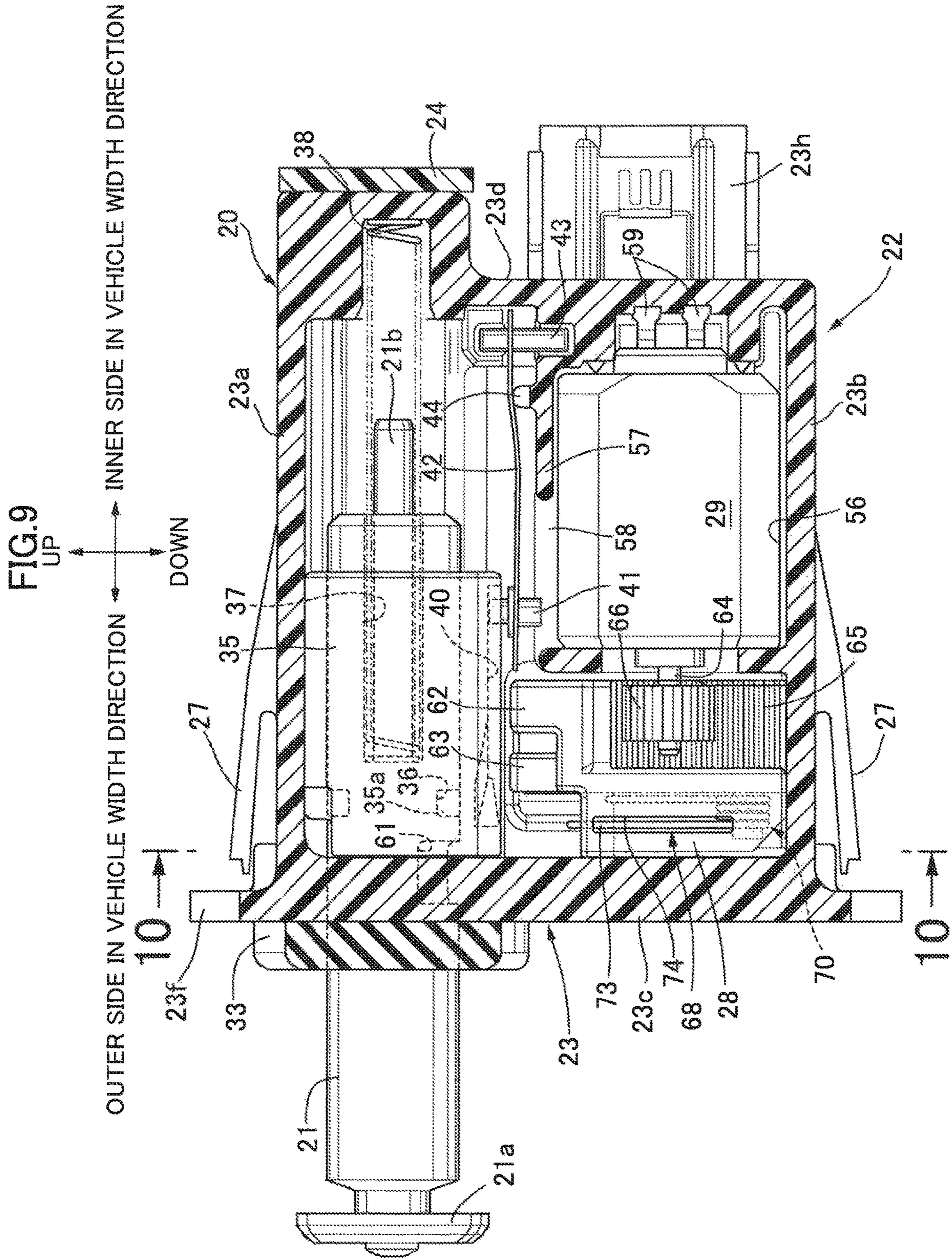


FIG.10

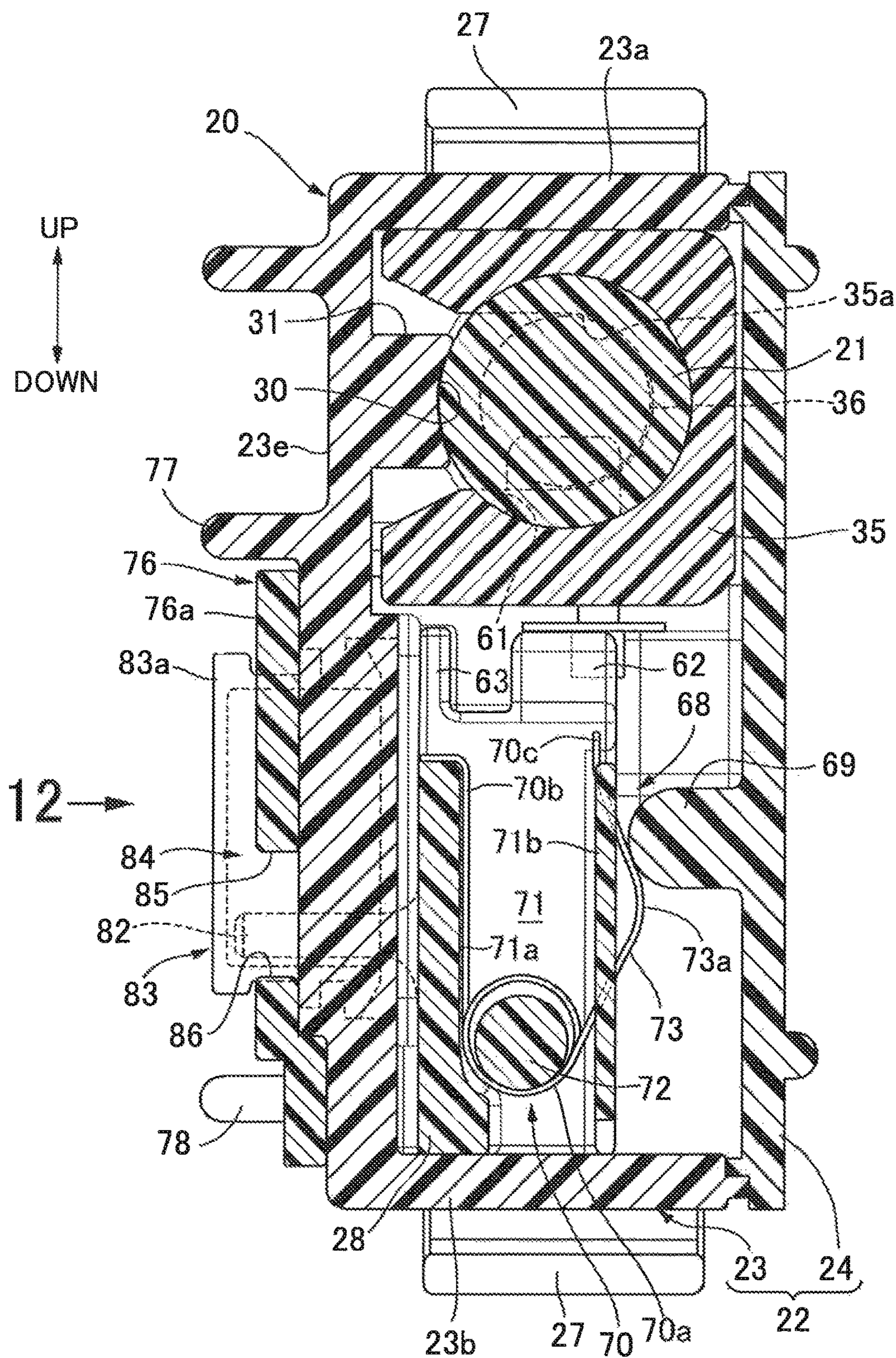


FIG.12

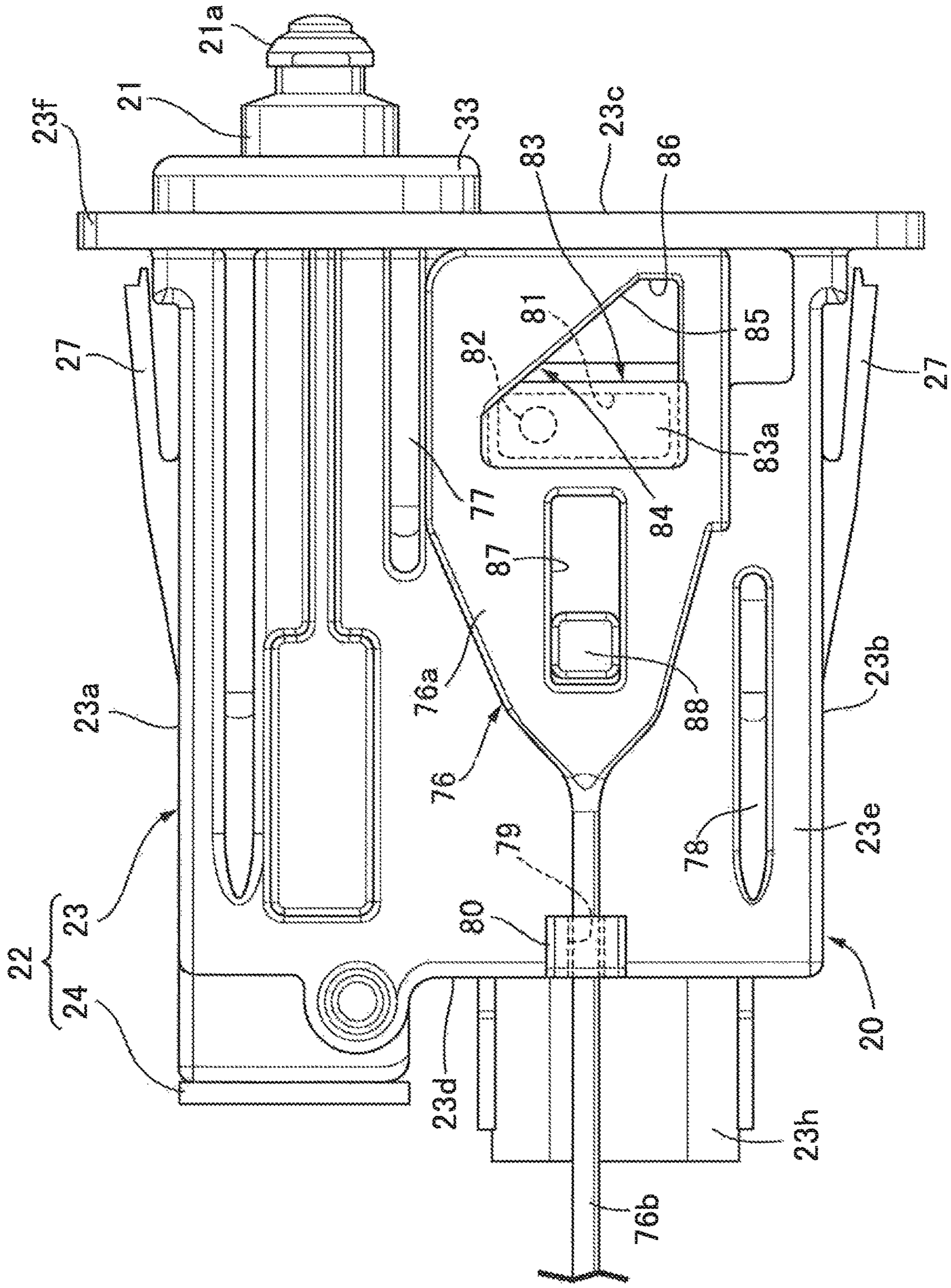
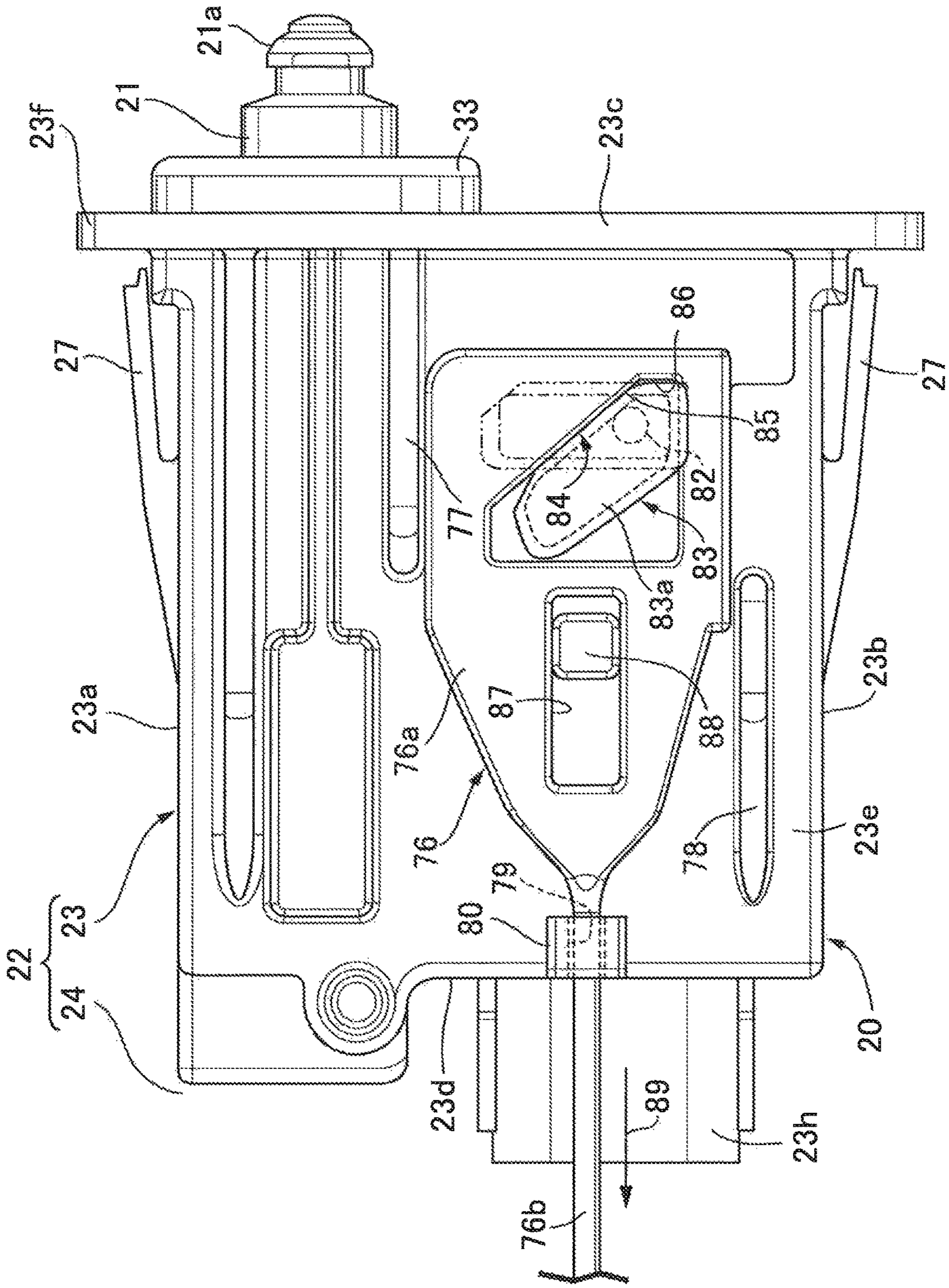


FIG. 13



LID OPENING AND CLOSING DEVICE FOR VEHICLE

TECHNICAL FIELD

The present invention relates to a lid opening and closing device for a vehicle that includes a rod that can move forward and backward between a pushed-in position in response to an openable and closable lid being pushed in and a protruding position when the lid is in an open state and that attains a lid closed position in which the rod is returned from the pushed-in position toward the protruding position side only by a predetermined amount of movement when the lid is in a closed state, a restriction member that can operate between a restriction position at which movement of the rod at the lid closed position is restricted and a restriction release position at which the restriction is released, an electric motor that operates for a predetermined time in response to a door switching between a locked state and an unlocked state so as to drive the restriction member while putting the restriction member at the restriction position when the door is in the locked state and putting the restriction member at the restriction release position when the door is in the unlocked state, and a case that supports the rod so that it can move forward and backward and houses the restriction member and the electric motor.

BACKGROUND ART

A lid opening and closing device for a vehicle in which a rod that can move forward and backward between a pushed-in position in response to a lid being pushed in and a protruding position when the lid is in an open state attains a lid closed position between the pushed-in position and the protruding position when the lid is in a closed state, axial movement of the rod is restricted by an electric motor driving a restriction member so as to engage with the rod when a door attains a locked state in a state in which the rod is at the lid closed position, and the restriction of axial movement of the rod is released by the electric motor driving the restriction member so as to release the engagement with the rod when the door attains an unlocked state is already known from Patent Document 1.

PRIOR ART DOCUMENTS

Patent Documents

Patent Document 1: Japanese Patent Application Laid-open No. 2016-117313

DISCLOSURE OF INVENTION

Problems to be Solved by the Invention

However, if a vehicle user erroneously puts the door into a locked state in a state in which the rod is at the protruding position, that is, the lid is open, the restriction member at the restriction release position is driven toward the restriction position side by the electric motor whereas the rod at the protruding position cannot engage with the restriction member, and the restriction member therefore stops at a halfway position before attaining the restriction position. When such a state occurs, in order to restrict movement of the rod by moving the rod from the protruding position to the lid closed position and hold the lid in a closed state, in the arrangement of Patent Document 1 it is necessary to carry out an

operation of switching the door from the locked state to the unlocked state, to carry out an operation of returning the restriction member to the restriction release position to thus move the rod to the lid closed position, then to put the door again into the locked state, and to drive the restriction member to the restriction position by means of the electric motor; a wasteful operation of returning the door to the unlocked state becomes necessary, and the convenience is poor.

The present invention has been accomplished in light of such circumstances, and it is an object thereof to provide a lid opening and closing device for a vehicle that has enhanced convenience by enabling a rod at a lid closed position to be restricted by means of a restriction member by carrying out an operation of locking a door by moving the rod to the lid closed position without requiring an unlocking operation even when the restriction member stops at position halfway between a restriction release position and a restriction position due to a locking operation in a state in which the rod is at a protruding position.

Means for Solving the Problems

In order to attain the above object, according to a first aspect of the present invention, there is provided a lid opening and closing device for a vehicle comprising a rod that can move forward and backward between a pushed-in position in response to an openable and closable lid being pushed in and a protruding position when the lid is in an open state and that attains a lid closed position in which the rod is returned from the pushed-in position toward the protruding position side only by a predetermined amount of movement when the lid is in a closed state, a restriction member that can operate between a restriction position at which movement of the rod at the lid closed position is restricted and a restriction release position at which the restriction is released, an electric motor that operates for a predetermined time in response to a door switching between a locked state and an unlocked state so as to drive the restriction member while putting the restriction member at the restriction position when the door is in the locked state and putting the restriction member at the restriction release position when the door is in the unlocked state, and a case that houses the restriction member and the electric motor, characterized in that the device comprises a holding mechanism that resiliently holds at least the restriction release position of the restriction member.

Further, according to a second aspect of the present invention, in addition to the first aspect, the holding mechanism is formed from an abutment part that is provided integrally with a case constituent member forming part of the case, and an elastic member that is mounted on the restriction member while abutting against the abutment part so as to urge the restriction member toward the restriction release position side at a position where the restriction member is partway through moving from the restriction release position toward the restriction position side.

A cover **24** of an embodiment corresponds to the case constituent member of the present invention.

Effects of the Invention

In accordance with the first aspect of the present invention, even if the door is erroneously locked in a state in which the rod is in the protruding position, due to the restriction release position of the restriction member being resiliently held by the holding mechanism, the restriction

member will not stop at a halfway position before attaining the restriction position, and the restriction member is held in the restriction release position. It is therefore unnecessary to carry out an operation of returning the door from the locked state to the unlocked state, and carrying out the locking operation after moving the rod to the lid closed position enables movement of the rod to be smoothly restricted, thus enhancing the convenience.

Furthermore, in accordance with the second aspect of the present invention, since the holding mechanism is formed from the elastic member mounted on the restriction member and the abutment part, against which the elastic member is abutted, and the abutment part is provided integrally with the case constituent member forming part of the case, it is possible to form the holding mechanism while avoiding any increase in the number of components.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view with a vehicle body exterior plate cut away showing a state in which a lid opening and closing device is mounted. (first embodiment)

FIG. 2 is a plan view of the lid opening and the closing device from the direction of arrow 2 in FIG. 1 when a rod is at a lid closed position. (first embodiment)

FIG. 3 is a sectional view along line 3-3 in FIG. 2 when a door is in a locked state. (first embodiment)

FIG. 4 is a sectional view, corresponding to FIG. 3, in a state in which an electric motor and a restriction member are removed. (first embodiment)

FIG. 5 is a sectional view along line 5-5 in FIG. 3. (first embodiment)

FIG. 6 is a sectional view along line 6-6 in FIG. 3. (first embodiment)

FIG. 7 is a diagram for explaining change of position of a pin within an axial position-restricting groove. (first embodiment)

FIG. 8 is a sectional view, corresponding to FIG. 3, of the lid opening and the closing device in a state in which the rod is at a pushed-in position. (first embodiment)

FIG. 9 is a sectional view, corresponding to FIG. 3, of the lid opening and the closing device in a state in which the rod is at a protruding position. (first embodiment)

FIG. 10 is a sectional view along line 10-10 in FIG. 9. (first embodiment)

FIG. 11 is a sectional view, corresponding to FIG. 10, when the door attains a locked state in a state in which the rod is at the protruding position. (first embodiment)

FIG. 12 is a view in the direction of arrow 12 in FIG. 5. (first embodiment)

FIG. 13 is a diagram, corresponding to FIG. 12, in a state in which an emergency operation member is operated. (first embodiment)

EXPLANATION OF REFERENCE NUMERALS AND SYMBOLS

- 17 Lid
- 21 Rod
- 22 Case
- 24 Cover, which is a case constituent member
- 28 Restriction member
- 29 Electric motor

- 68 Holding mechanism
- 69 Abutment part
- 70 Elastic member

MODES FOR CARRYING OUT THE INVENTION

An embodiment of the present invention is explained by reference to FIG. 1 to FIG. 13.

First Embodiment

First, in FIG. 1, a recess part 16 is formed in a vehicle body exterior plate 15 of a vehicle, a fuel supply part, which is not illustrated, facing the recess part 16, and a base end part of a lid 17 is pivotably supported on the vehicle body exterior plate 15, the lid 17 openably and closably closing the recess part 16. A latching part 18 is provided on an inner face on a free end side of the lid 17, and a case 22 of a lid opening and closing device 20 is mounted on a bottom wall 16a of the recess part 16, the lid opening and closing device 20 having a rod 21 having provided on its extremity part an engagement portion 21a that detachably engages with the latching part 18.

Referring in addition to FIG. 2 to FIG. 6, the case 22 is formed from a case main body 23 formed into a rectangular box shape and a cover 24 joined to the case main body 23 so as to close an open end of the case main body 23.

The case main body 23 integrally has an upper side wall 23a and lower side wall 23b extending in the vehicle width direction with a gap therebetween in the vertical direction, an outer side wall 23c extending in the vertical direction while joining end parts on the outer side in the vehicle width direction of the upper and lower side walls 23a and 23b, an inner side wall 23d extending in the vertical direction while joining end parts on the inner side in the vehicle width direction of the upper and lower side walls 23a and 23b, and a flat plate-shaped end wall 23e connectedly provided in common on end parts on one side in the vehicle fore-and-aft direction of the upper side wall 23a, the lower side wall 23b, the outer side wall 23c and the inner side wall 23d. The cover 24 is joined to the case main body 23 from the other side in the vehicle fore-and-aft direction so as to oppose the end wall 23e.

A rectangular insertion hole 25 (see FIG. 1) is formed in the bottom wall 16a of the recess part 16, and the case 22 is inserted into the insertion hole 25 from the outer side in the vehicle width direction. Moreover, a rectangular collar portion 23f is integrally and connectedly provided with the outer side wall 23c of the case main body 23 so as to protrude outward from the outer periphery thereof, and the case 22 is inserted into the insertion hole 25 from the outer side in the vehicle width direction so that a rectangular inner seal member 26 surrounding an end part, on the collar portion 23f side, of the case 22 is disposed between the collar portion 23f and an outer face of the bottom wall 16a at the peripheral edge of the insertion hole 25. A base end part of an elastic claw 27 is connectedly provided on the upper side wall 23a and the lower side wall 23b of the case main body 23, the elastic claw 27 passing through the insertion hole 25 due to it flexing when the case 22 is inserted into the insertion hole 25, and an extremity part of the elastic claw 27 abutting against an inner face of the bottom wall 16a. That is, the inner seal member 26 and the bottom wall 16a are held between the collar portion 23f and the elastic claw 27, thereby mounting the case 22 on the bottom wall 16a.

The lid opening and closing device 20 includes the rod 21, a restriction member 28 that can restrict movement of the rod 21, and an electric motor 29 that drives the restriction

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member 28, and the restriction member 28 and the electric motor 29 are housed within the case 22.

The rod 21 is disposed so as to extend in the vehicle width direction in an upper part of the case 22 and is movably supported on the case main body 23 of the case 22. A support rib 31 extends in the longitudinal direction of the rod 21 and is integrally and projectingly provided on an inner face of the end wall 23e of the case main body 23, the support rib 31 having on the protruding end a sliding contact support face 30 that is recessed into an arc shape so as to be in sliding contact with part of an outer peripheral face of the rod 21, which has a circular cross section. A through hole 32 is formed in an upper part of the outer side wall 23c of the case main body 23, the rod 21 being axially movably inserted through the through hole 32, a short cylindrical portion 23g protruding from the outer side wall 23c toward the recess part 16 side so as to form part of the through hole 32 is integrally and projectingly provided on the upper part of outer side wall 23c, and an annular outer seal member 33 is fitted onto the short cylindrical portion 23g, the outer seal member 33 being in resilient sliding contact with the outer periphery of the rod 21.

A holder 35 is fitted onto the rod 21 within the case 22. The holder 35 is formed so as to have a substantially U-shaped cross-sectional shape that opens on the end wall 23e side, and an engagement collar 35a is formed integrally with the holder 35, the engagement collar 35a being engaged with an annular groove 36 formed in the outer periphery of the rod 21. The holder 35 is thereby fitted onto the rod 21 so that it can pivot relative thereto within a limited range around the axis of the rod 21 while being unable to move relative to the rod 21 in the axial direction.

A ring-shaped spring housing recess part 37 is formed in the rod 21 at a location close to the inner side wall 23d of the case main body 23 so as to be coaxial with the axis of the rod 21 and open on the outer side wall 23c side, and a coil spring 38 partially housed within the spring housing recess part 37 is provided between the rod 21 and the outer side wall 23c.

The rod 21 is urged, by the resilient force of the coil spring 38, in a direction in which the engagement portion 21a on its extremity part protrudes from the vehicle body exterior plate 15, and in order to restrict the axial position of the rod 21 an axial position-restricting groove 40 shown in FIG. 7 is formed in an outer face of the holder 35 on the side opposite to the upper side wall 23a of the case main body 23, a pin 41 being inserted into the axial position-restricting groove 40.

An arm plate 42 formed from a plate spring is disposed between the holder 35 and the electric motor 29 so as to extend lengthwise in the longitudinal direction of the rod 21, a shaft 43 inserted into a base end part of the arm plate 42 is held between the case main body 23 and the cover 24, and the arm plate 42 is supported on the shaft 43 so that it can pivot within a permitted range within the case 22.

The pin 41 is fixed close to the free end part of the arm plate 42, and a projecting part 44 is projectingly provided on the case main body 23, the projecting part 44 abutting against a location close to the base end part of the arm plate 42 from the side opposite to the rod 21. The arm plate 42 thereby exhibits a resilient force that urges the pin 41 toward the holder 35 side.

The rod 21 is capable of moving forward and backward between a pushed-in position in which it is pushed in against the resilient force of the coil spring 38 as shown in FIG. 8 in response to the lid 17 in a closed state and an open state being pushed in, and a protruding position in which it is

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made to protrude greatly from the case 22 by means of the resilient force of the coil spring 38 as shown in FIG. 9 when the lid 17 is in the open state and, moreover, when the lid 17 is in the closed state the rod 21 attains, as shown in FIG. 2, FIG. 3, FIG. 4 and FIG. 6, a lid closed position in which it returns from the pushed-in position toward the protruding position side only by a predetermined amount of movement.

A round bar-shaped stopper 21b is coaxially, integrally and projectingly provided on the rod 21 in an end part on the inner side wall 23d of the case main body 23, and when as shown in FIG. 8 the rod 21 is in the pushed-in position the stopper 21b, abuts against the inner side wall 23d of the case main body 23 and restricts the movement end of the rod 21 in the pushing-in direction. The holder 35 functions to restrict the protruding position of the rod 21, and the holder 35 is mounted on the rod 21 so that in a state in which the rod 21 is in the protruding position, as shown in FIG. 9 the holder 35 abuts against the outer side wall 23c of the case main body 23 and restricts the movement end of the rod 21 in the protrusion direction.

Referring to FIG. 7, the axial position-restricting groove 40 is formed so as to have a pin-receiving portion 40a that is made to abut against the pin 41 in a direction along an urging direction shown by arrow 45 while preventing the rod 21 from moving to the protruding position by receiving, with the pin 41, the holder 35 urged in the urging direction together with the rod 21 by means of the coil spring 38 when the rod 21 is in the lid closed position, first and second pushed-in position-receiving portions 40b and 40c that receive the pin 41 when the rod 21 and the holder 35 are in the pushed-in position, and a protruding position-receiving portion 40d that receives the pin 41 when the rod 21 and the holder 35 are in the protruding position.

When the lid 17 in the closed position is pushed in, the pin 41 is displaced as shown by an arrow 46 from the pin-receiving portion 40a to the first pushed-in position-receiving portion 40b by means of movement of the rod 21 and the holder 35 to the pushed-in position, and when the rod 21 and the holder 35 are moved to the protruding position due to release of a force pushing in the lid 17 the pin 41 is displaced as shown by an arrow 47 from the first pushed-in position-receiving portion 40b to the protruding position-receiving portion 40d. When the rod 21 is pushed in together with the lid 17 in a state in which the lid 17 is in the open position, the pin 41 is displaced as shown by an arrow 48 to the second pushed-in position-receiving portion 40c due to movement of the rod 21 and the holder 35 to the pushed-in position, and when the rod 21 and the holder 35 are moved to the lid closed position due to release of a force pushing in the lid 17, the pin 41 is displaced as shown by an arrow 49 from the second pushed-in position-receiving portion 40c to the pin-receiving portion 40a, and abuts against the pin-receiving portion 40a.

Formed in the axial position-restricting groove 40 are a first step part 50 that prevents reverse displacement of the pin 41 from the pin-receiving portion 40a to the second pushed-in position-receiving portion 40c, a second step part 51 that prevents reverse displacement of the pin 41 from the first pushed-in position-receiving portion 40b to the pin-receiving portion 40a, a third step part 52 that prevents reverse displacement of the pin 41 from the protruding position-receiving portion 40d to the first pushed-in position-receiving portion 40b, and a fourth step part 53 that prevents reverse displacement of the pin 41 from the second pushed-in position-receiving portion 40c to the protruding position-receiving portion 40d.

The engagement portion **21a** in the extremity part of the rod **21** has a substantially T-shaped form; in a state in which the lid **17** is in the closed position the engagement portion **21a** is engaged with the latching part **18** and when the lid **17** is opened the engagement with the latching part **18** is released, and due to the rod **21** spinning on its axis by 90 degrees the engagement portion **21a** is switched between engagement with the latching part **18** and release of the engagement.

Referring to FIG. 6, a helical guide groove **54** is formed in an outer periphery of the rod **21** that faces the end wall **23e** side of the case main body **23**, and a projection **55** projecting into the guide groove **54** is integrally and projectingly provided on the end wall **23e**. The guide groove **54** is formed so as to make the rod **21** spin on its axis by 90 degrees while the rod **21** moves in the axial direction between the pushed-in position and the protruding position.

The electric motor **29** has a rotational axis parallel to the axis of the rod **21**, and is housed within the case **22** so as to be disposed toward the inner side of the case main body **23** beneath the rod **21** and the holder **35**. Integrally and projectingly provided on the case main body **23** is a substantially L-shaped dividing wall **57** that forms, in cooperation with the inner side wall **23d** and the lower side wall **23b**, a motor housing recess part **56** housing the electric motor **29**. Moreover, formed in the dividing wall **57** is a cutout part **58** that houses part of the pin **41** fixed to the arm plate **42**. Formed integrally with the inner side wall **23d** is a connector portion **23h**, a pair of connection terminals **59** connected to the electric motor **29** facing the interior of the connector portion **23h**.

The restriction member **28** is housed within the case **22** so as to be disposed beneath the rod **21** and holder **35** further outside in the vehicle width direction than the electric motor **29**, and is housed in the case **22** so as to operate in a direction orthogonal to the direction of forward and backward movement of the rod **21**, that is, in the vertical direction in this embodiment, between a restriction position as shown in FIG. 3 and FIG. 5 in which it engages with the rod **21** in the lid closed position and restricts movement of the rod **21** and a restriction release position as shown in FIG. 8, FIG. 9 and FIG. 10 in which it releases engagement with the rod **21**, moves to the side away from the rod **21**, and releases restriction of the rod **21**.

A latching recess part **61** facing the restriction member **28** side when rod **21** is in the lid closed position is formed in the outer periphery of the rod **21**, and an engagement projection **62** that is fitted into and engaged with the latching recess part **61** when the rod **21** is in the lid closed position is projectingly provided on an end part, on the rod **21** side, of the restriction member **28**. A stopper **63** is integrally and projectingly provided on the end part, on the rod **21** side, of the restriction member **28**, the stopper **63** determining the restriction position of the restriction member **28** by abutting against the support rib **31** projectingly provided on the inner face of the end wall **23e** as shown in FIG. 5 when the restriction member **28** moves to the restriction position in a state in which the rod **21** is in the lid closed position.

An output shaft **64** of the electric motor **29** has an axis parallel to the axis of the rod **21**, that is, orthogonal to the direction of operation of the restriction member **28**, and rotatably extends through the dividing wall **57** and protrudes on the restriction member **28** side. On the other hand, a rack **65** is provided on the restriction member **28** so as to extend along the direction of movement thereof, and a pinion **66** provided on the output shaft **64** meshes with the rack **65**. The restriction member **28** is therefore driven so as to operate

between the restriction position and the restriction release position by means of operation of the electric motor **29**.

The electric motor **29** operates only for a predetermined time (e.g. 0.6 sec) in response to the vehicle door being switched between the locked state and the unlocked state by means of a keyless button operation of a vehicle user or a smart entry system; the electric motor **29** drives the restriction member **28** to the restriction position when the door is in the locked state, and the electric motor **29** drives the restriction member **28** to the restriction release position when the door is in the unlocked state.

In a state in which the rod **21** is in the protruding position, that is, a state in which the lid **17** is open, if a vehicle user erroneously puts the door into a locked state, although the restriction member **28** in the restriction release position is driven to the restriction position side by means of the electric motor **29**, the restriction member **28** is unable to engage with the rod **21** in the protruding position; as shown in FIG. 11, the engagement projection **62** and the stopper **63** of the restriction member **28** abut against the holder **35** before attaining the restriction position, and movement of the restriction member **28** to the restriction position is thus prevented. Because of this, when operation of the electric motor **29** is stopped, there is a possibility that the restriction member **28** will stop at a halfway position before attaining the restriction position, but the restriction member **28** is returned to the restriction release position by the action of a holding mechanism **68**.

The holding mechanism **68** resiliently holds at least the restriction release position of the restriction member **28** and is formed from an abutment part **69** provided integrally with the cover **24** as a case constituent member forming part of the case **22**, and an elastic member **70** that is mounted on the restriction member **28** while abutting against the abutment part **69** so as to urge the restriction member **28** toward the restriction release position side when the restriction member **28** is at a position where it is partway through moving from the restriction release position toward the restriction position side.

A groove **71** is formed in the restriction member **28** over the entire length along the direction of movement of the restriction member **28**, the groove **71** opening on the outer side wall **23c** side of the case main body **23**, and a support shaft **72** disposed within the groove **71** is integrally and projectingly provided on the restriction member **28**. The elastic member **70** has a coil portion **70a** surrounding the support shaft **72** and first and second arm portions **70b** and **70c** extending from opposite ends of the coil portion **70a**.

The first arm portion **70b** of the elastic member **70** abuts against and is supported on the side wall **71a**, which is, among side walls **71a** and **71b** on opposite sides of the groove **71**, further from the cover **24**. An extremity part of the second arm portion **70c** abuts against and is supported, among the side walls **71a** and **71b** on opposite sides of the groove **71**, on the side wall **71b** on the cover **24** side, and an angled elastic part **73** curving so as to bulge on the cover **24** side is formed on an intermediate part of the second arm portion **70c**. A slit **74** having the elastic part **73** inserted therethrough is provided in the restriction member **28**, the elastic part **73** protruding from the slit **74** toward the cover **24** side.

On the other hand, the abutment part **69** projectingly provided on the cover **24** always abuts against the elastic part **73**; in a state in which the restriction member **28** is in the restriction release position, as shown in FIG. 10 the elastic part **73** abuts against the abutment part **69** via a portion further toward the extremity part side of the second

arm portion **70c** than an angled apex portion **73a**, and the elastic part **73** exhibits a resilient force urging the restriction member **28** toward the restriction release position side. In a state in which the restriction member **28** is in the restriction position, as shown in FIG. **5** the elastic part **73** abuts against the abutment part **69** via a portion further toward the side opposite to the extremity part of the second arm portion **70c** than the angled apex portion **73a**, and the elastic part **73** exhibits a resilient force urging the restriction member **28** toward the restriction position side. When the restriction member **28** is as shown in FIG. **11** in an intermediate position between the restriction position and the restriction release position, without the abutment part **69** overriding the apex portion **73a** of the elastic part **73** the elastic part **73** abuts against the abutment part **69** via a portion further on the extremity part side of the second arm portion **70c** than the apex portion **73a**, and the elastic part **73** exhibits a resilient force urging the restriction member **28** toward the restriction release position side. When the restriction member **28** is driven toward the restriction position side by means of the electric motor **29** and the restriction member **28** attains a halfway position before attaining the restriction position, the restriction member **28** is thereby returned to the restriction release position by the action of the holding mechanism **68** accompanying operation of the electric motor **29** being stopped.

When the electric motor **29** malfunctions, since the lid **17** cannot be opened unless the restriction member **28** restricting the rod **21** in a lid closed state is returned to the restriction release position by a manual operation, the lid opening and closing device **20** is provided with an emergency operation member **76** that is capable of moving the restriction member **28** to the restriction release position when the electric motor **29** malfunctions.

In FIG. **12**, the emergency operation member **76** is capable of moving in a direction parallel to the direction of movement of the rod **21** along an outer face of the end wall **23e** of the case main body **23** of the case **22**, and integrally has a flat plate-shaped operating member main portion **76a** that is in sliding contact with the outer face of the end wall **23e**, a rod-shaped portion **76b** that is connected integrally to the operation main part and extends inward in the vehicle width direction in parallel with the direction of movement of the rod **21**, and an operating portion **76c** that has a circular hole and is provided on an extremity part of the rod-shaped portion **76b**.

Integrally and projectingly provided on an outer face of the end wall **23e** are an upper guide rib **77** that can come into sliding contact with an upper edge part of the operating member main portion **76a**, and a lower guide rib **78** that can come to sliding contact with a lower edge part of the operating member main portion **76a**, the upper guide rib **77** and the lower guide rib **78** extending in parallel with the direction of forward and backward movement of the rod **21** at positions spaced in the vertical direction. Integrally and projectingly provided on the outer face of the end wall **23e** is a guide projecting part **80** having a guide hole **79** into which the rod-shaped portion **76b** is movably fitted.

Integrally and projectingly provided on the restriction member **28** is a rod-shaped projection **82** that extends through a rectangular opening **81** (see FIG. **4**) provided in the end wall **23e** and protrudes upward, the opening **81** being formed lengthwise along the direction of movement of the restriction member **28** so as to allow movement of the projection **82** when the restriction member **28** moves between the restriction release position and the restriction position. Furthermore, a seal rubber **83** having a rectangular

pouch portion **83a** covering the projection **82** from the outside is fitted into the opening **81**.

An operating force-acting direction conversion mechanism **84** is provided between the restriction member **28** and the emergency operation member **76**. When the emergency operation member **76** is operated in a direction parallel to the direction of forward and backward movement of the rod **21** so as to move the emergency operation member **76**, the operating force-acting direction conversion mechanism **84** converts the operating force from the emergency operation member **76** into a force operating the restriction member **28** from the restriction position toward the restriction release position in a direction orthogonal to the direction of forward and backward movement of the rod **21**.

This operating force-acting direction conversion mechanism **84** is formed from the projection **82** integrally and projectingly provided on the restriction member **28** and a cam part **85** that is formed on the emergency operation member **76** in an inclined manner so as to obliquely intersect the direction of operation of the restriction member **28** and abuts against the projection **82**. One side edge of a window **86** formed in the operating member main portion **76a** so as to have the pouch portion **83a** of the seal rubber **83** inserted therethrough is inclined as the cam part **85** so as to obliquely intersect the direction of operation of the restriction member **28**.

The operating member main portion **76a** of the emergency operation member **76** has provided therein a guide hole **87** extending lengthwise in the direction of movement thereof. Projectingly provided on the outer face of the end wall **23e** of the case main body **23** of the case **22** is a guide projection **88** that projects into the guide hole **87** so as to guide movement of the emergency operation member **76** and restrict the end of movement of the emergency operation member **76**.

When the emergency operation member **76** is operated in the direction shown by an arrow **89** in FIG. **13** in a state in which the restriction member **28** is in the restriction position, the operating force from the emergency operation member **76** in a direction parallel to the direction of forward and backward movement of the rod **21** is converted, and a force that operates the restriction member **28** from the restriction position to the restriction release position in a direction orthogonal to the direction of forward and backward movement of the rod **21** acts on the projection **82** of the restriction member **28** via the pouch portion **83a** of the seal rubber **83**. In this arrangement, the pouch portion **83a** of the seal rubber **83** deforms and flexes as shown in FIG. **13**, and the reaction force of the pouch portion **83a** makes the emergency operation member **76** return to the original position.

The operation of the embodiment is now explained; since the lid opening and closing device **20** includes the holding mechanism **68** resiliently holding at least the restriction release position of the restriction member **28**, even if the door is erroneously locked in a state in which the rod **21** is in the protruding position, due to the restriction release position of the restriction member **28** being resiliently held by the holding mechanism **68**, the restriction member **28** will not stop at a halfway position before attaining the restriction position, and the restriction member **28** is held in the restriction release position. It is therefore unnecessary to carry out an operation of returning the door from the locked state to the unlocked state, and carrying out the locking operation after moving the rod **21** to the lid closed position enables movement of the rod **21** to be smoothly restricted, thus enhancing the convenience.

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Furthermore, since the holding mechanism **68** is formed from the abutment part **69** provided integrally with the cover **24** forming part of the case **22**, and the elastic member **70** mounted on the restriction member **28** while abutting against the abutment part **69** so as to urge the restriction member **28** toward the restriction release position side when the restriction member **28** is at position where it is partway through moving from the restriction release position toward the restriction position side, it is possible to form the holding mechanism **68** while avoiding any increase in the number of components.

Moreover, since the operating force-acting direction conversion mechanism **84**, which converts the operating force from the emergency operation member **76** in the direction parallel to the direction of forward and backward movement of the rod **21** into the force for operating the restriction member **28** from the restriction position toward the restriction release position is provided between the restriction member **28** and the emergency operation member **76** of the lid opening and closing device **20**, when the emergency operation member **76** is operated in the direction parallel to the direction of forward and backward movement of the rod **21**, the restriction member **28** is operated from the restriction position toward the restriction release position in the direction orthogonal to the direction of forward and backward movement of the rod **21** by the action of the operating force-acting direction conversion mechanism **84**, and due to the direction of operation of the emergency operation member **76** being made parallel to the direction of forward and backward movement of the rod **21** it is possible to enhance the ease of assembly without widening the insertion hole **25** provided in the vehicle body exterior plate **15**.

Furthermore, since the operating force-acting direction conversion mechanism **84** is formed from the projection **82**, which is integrally and projectingly provided on the restriction member **28**, and the cam part **85**, which is formed on the emergency operation member **76** in an inclined manner so as to obliquely intersect the operating direction of the restriction member **28** and abuts against the projection **82**, it is possible to form the operating force-acting direction conversion mechanism **84** as a simple and small structure while avoiding any increase in the number of components by eliminating the necessity for the use of a link mechanism, etc., thus enabling a small size to be achieved for the lid opening and closing device **20**.

Moreover, since the emergency operation member **76** is provided with the guide hole **87** extending lengthwise in the direction of movement thereof, and the guide projection **88** is projectingly provided on the case **22**, the guide projection **88** projecting into the guide hole **87** so as to guide movement of the emergency operation member **76** and restrict the end of movement of the emergency operation member **76**, it is

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possible to guide movement of the emergency operation member **76** and restrict the end of movement of the emergency operation member **76** with a simple arrangement in which the guide projection **88** projectingly provided on the case **22** projects into the guide hole **87** provided in the emergency operation member **76**.

An embodiment of the present invention is explained above, but the present invention is not limited to the above embodiment and may be modified in a variety of ways as long as the modifications do not depart from the subject matter.

The invention claimed is:

1. A lid opening and closing device for a vehicle comprising: a rod that moves forward and backward between a pushed-in position in response to an openable and closable lid being pushed inward of the vehicle and a protruding position when the lid is in an open state and that attains a lid closed position in which the rod is returned from the pushed-in position toward the protruding position side only by a predetermined amount of movement when the lid is in a closed state, a restriction member that moves between a restriction position at which the restriction member restricts movement of the rod at the lid closed position and a restriction release position at which the restriction member's restriction of movement of the rod is released, an electric motor that operates for a predetermined time in response to a door of the vehicle being switched between a locked state and an unlocked state so as to drive the restriction member such that the restriction member is moved to the restriction position when the door is switched to the locked state and the restriction member is switched to the restriction release position when the door is switched to the unlocked state, a case that houses the restriction member and the electric motor, and a holding mechanism that resiliently holds the restriction member at at least the restriction release position thereof.

2. The lid opening and closing device for a vehicle according to claim 1, wherein the holding mechanism is formed from an abutment part that is provided integrally with a case constituent member forming part of the case, and an elastic member that is mounted on the restriction member while abutting against the abutment part so as to urge the restriction member toward the restriction release position side where the restriction member is at a position partway through moving from the restriction release position toward the restriction position side.

3. The lid opening and closing device for a vehicle according to claim 1, wherein the holding mechanism contacts the restriction member and urges the restriction member toward the restriction release position.

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